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Demonstration Bulletin

Soil Rescue Remediation Solution

Star Organics, L.L.C.

Technology Description: Star Organics, L.L.C. (Star), has developed a remediation solution that binds heavy metal contaminants in soils and sludges. The solution, Soil Rescue, consists of weak organic acids that occur naturally in trace concentrations in the soil, phosphoryl esters, and other organic components. The solution is typically surface sprayed where contamination is shallow (to about 8 inches), or pressure-injected where contamination is deeper. The application of Soil Rescue can be repeated, if necessary, until the contaminant metal concentrations are reduced to below applicable cleanup standards.

According to Star Organics, Soil Rescue does not destroy or remove toxic metals from the soil or sludge. Instead, the metals are bound in coordinate covalent complexes having large molecular structures and very low solubility. Soil Rescue is essentially a mixture of weak organic acids and phosphoryl esters that stabilize toxic metals by forming multiple ligands with a central metal cation.

Waste Applicability: According to Star Organics, Soil Rescue remediation solution is effective in reducing the solubility of barium, cadmium, chromium, copper, lead, and zinc. In situ remediation of contaminated soil may be achieved in permeable soils with shallow contamination by spraying Soil Rescue onto the surface. Where poor permeability does not permit fluid penetration, or where contamination is more than 8 inches below the surface (up to 15 feet), Soil Rescue may be applied using pressure-injection. For those situations where surface spraying or pressure-injection do not apply, Soil Rescue can be applied to excavated soil in a pug mill. The soil can be treated on site and placed back in its original location. For sites with high concentrations of leachable heavy metals, the application process (surface spraying, pressure injection, or pug mill) can be repeated until the concentrations of metals in the media are reduced to levels below the applicable cleanup standards.

Evaluation Approach: The Ohio Environmental Protection Agency (Ohio EPA) and U. S. EPA, through a cooperative agreement, evaluated the Soil Rescue remediation solution at the Crooksville/Roseville Pottery Area of Concern (CRPAC) in Roseville, Ohio. Soil Rescue was evaluated at CRPAC to determine its ability to reduce the amount of leachable lead in industrial and residential soils, as determined by the Toxicity Characteristic Leaching Procedure (TCLP). Soil Rescue was concurrently evaluated for its ability to reduce the relative percent of bioavailable lead as determined by a Physiological-based Extraction Test (PBET) in residential soils.

The evaluation consisted of treating 10 experimental units in a residential area, and one experimental unit in an industrial area. The experimental units in the residential area measured 5 feet long by 5 feet wide. The experimental unit at the industrial site measured 6 feet long by 3 feet wide. After the sod was removed from all of the experimental units, the contaminated soil was mechanically mixed to a depth of 6 inches. Soil samples were collected before the treatment process was applied. The experimental units were treated with Soil Rescue by spraying the remediation solution onto the surface, and then treating the soil to a depth of 2 feet by injecting the solution using an injection wand. The units were resampled after a minimum of 72 hours following the application of Soil Rescue. The original sod cover was returned to nine of the experimental units; one residential unit was reseeded with fescue to determine whether plant uptake of contaminants occurred following treatment. Lysimeters were installed to a depth of 6 inches in one unit at the residential site and in the unit at the industrial site. The water collected in the lysimeters will be analyzed on a quarterly basis for lead to aid in determining the long-term effectiveness of the treatment.

Preliminary Results: Results of the pre- and post-treatment TCLP lead analysis for the pretreated and post treated industrial soils are shown in Table 1. Results of the TCLP lead analysis for the residential soils are shown in Table 2. Key findings, including complete analytical results and a cost analysis, will be published in a Technology Capsule and an Innovative Technology Evaluation Report.

Table 1. TCLP Lead Results in Industrial Soils

Sampling Location	Pretreatment TCLP Lead Concentration (mg/L)	Post-treatment TCLP Lead Concentration (mg/L)
U1	453	3.2
U2	376	3.0
U3	411	3.6
U4	364	3.5
U5	411	2.7
U6	N/A	4.0
U7	N/A	2.9
U8	N/A	3.2
U9	N/A	3.2

Note:

N/A Statistical design of the experiment only required five pretreatment samples for TCLP analyses.

Table 2. TCLP Lead Results in Residential Soils

Experimental Unit	Pretreatment TCLP Lead Concentration (mg/L)	Post-treatment TCLP Lead Concentration (mg/L)
G	13.2	1.3
L	11.9	1.4
T	ND	ND

Note:

ND Not detected at the reporting limit of 0.50 mg/L.

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